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National Defense Center for Energy and Environment

Evaluation of Alternative Particle Filtration Designs to Reduce RDX Losses in Dewatering Operations

Ms. Jessica Grembi, *CTC*/NDCEE

DoD Executive Agent

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Holston Army Ammunition Plant (AAP) Description

- Falls under the Joint Munitions Command and is a government-owned, contractor-operated (GOCO) facility
- Manufactures a wide range of secondary detonating explosives including Royal Demolition eXplosive (RDX), High Melting eXplosive (HMX), Triaminotrinitrobenzene (TATB), Nitro Triazolene (NTO), and related formulations
- U.S. Army Production Plant for Energetic Explosive Materials

Background

- Morristown 50 miles downstream of Holston Army Ammunition Plant (AAP) uses Holston River as their drinking water source
  - Center for Health Promotion and Preventive Medicine (CHPPM) determined in 2005-2006, RDX level at Morristown meets standards of <2 parts per billion (ppb)
- New municipal drinking water intake proposed for Church Hill, 5 miles downstream of Holston AAP must meet same <2 ppb RDX limit

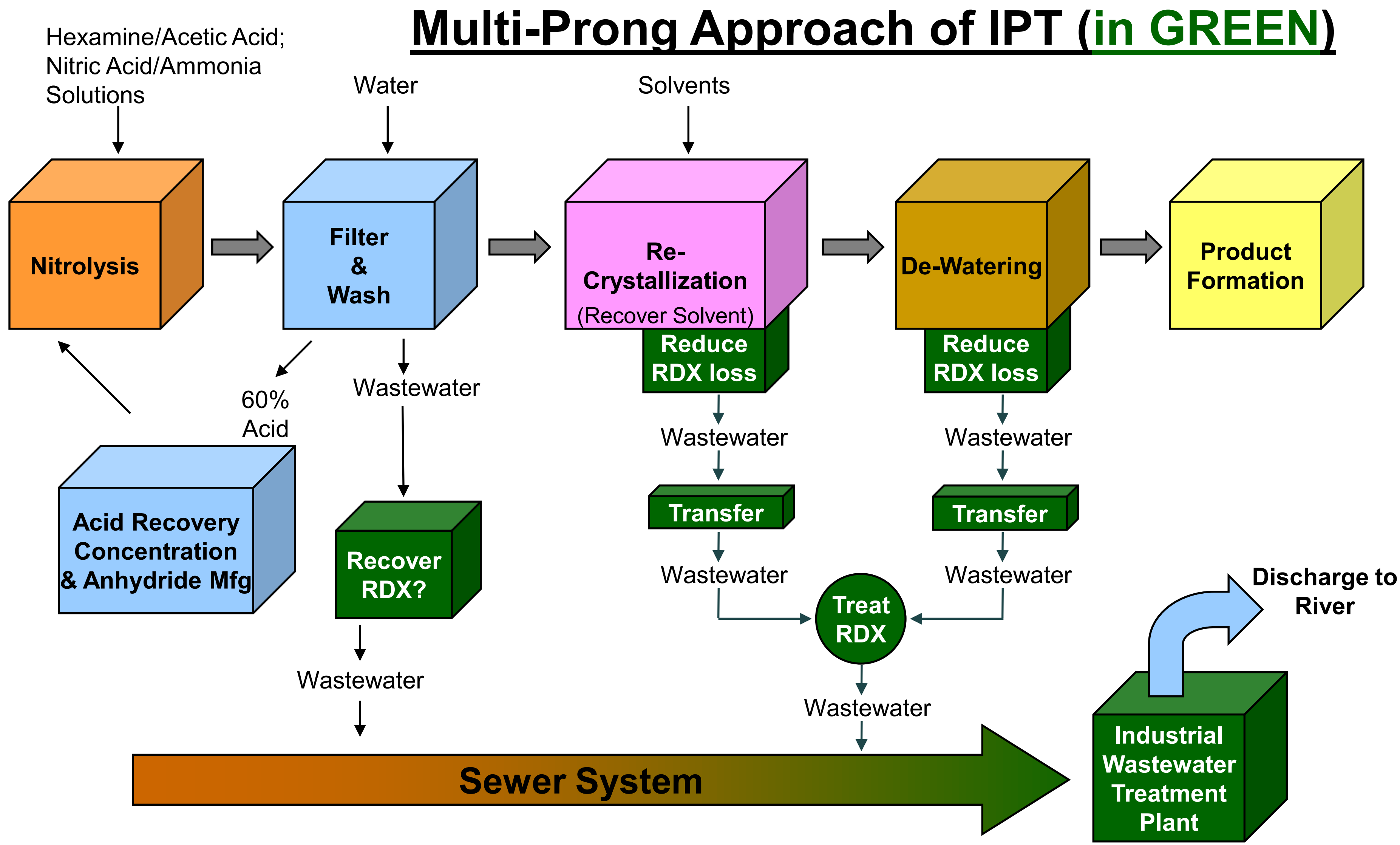
Problem Statement

- Motivated by the newly proposed Church Hill drinking water plant, the State of Tennessee has proposed a <12.2 pounds (lbs) RDX per day discharge permit limit for Holston AAP with a 5-year implementation schedule
- The current RDX manufacturing process sends up to 90 lbs of unrecovered (sparingly soluble) RDX per day through wastewater treatment
- **The RDX in wastewater is lost product!**

Integrated Process Team Approach

- System approach to identify problem in each phase of RDX manufacturing, including final treatment:
  - Manufacturing and Handling Operation
  - Recovery (Pollution Prevention)
  - Treatment (New Technology)
  - Integration of total operation
- Identify specific nature of the problem
- Evaluate current IWTP operations to determine efficiency of dilute dissolved RDX removal
- Evaluate manufacturing process to determine minimization of RDX entering wastewater stream
- Evaluate additional treatment options for concentrated RDX (prior to mixing with other waste streams at IWTP)

Project Focus Area: RDX Manufacturing



Integrated Process Team Members

Focus of this presentation

Reduce RDX in Wastewater

- Concurrent Technologies Corporation (*CTC*)/NDCEE

IWTP Efficiency

- Science Applications International Corporation (SAIC)

Initial Assessment

- Engineer Research and Development Center- Construction Engineering Research Laboratory (ERDC-CERL)
- CCR Environmental

Operations/ Oversight

- Holston AAP
- BAE Systems OSI
- PM JS
- PEO Ammo

New Technologies for Concentrated RDX Treatment

- ERDC-CERL
- Stevens Institute of Technology (SIT)/SAIC
- Reverse Osmosis

Identify Spe

- Study to determi

Solids dropping from sock probes were being washed into wastewater stream

↓

Consensus to eliminate solids dropping onto floor

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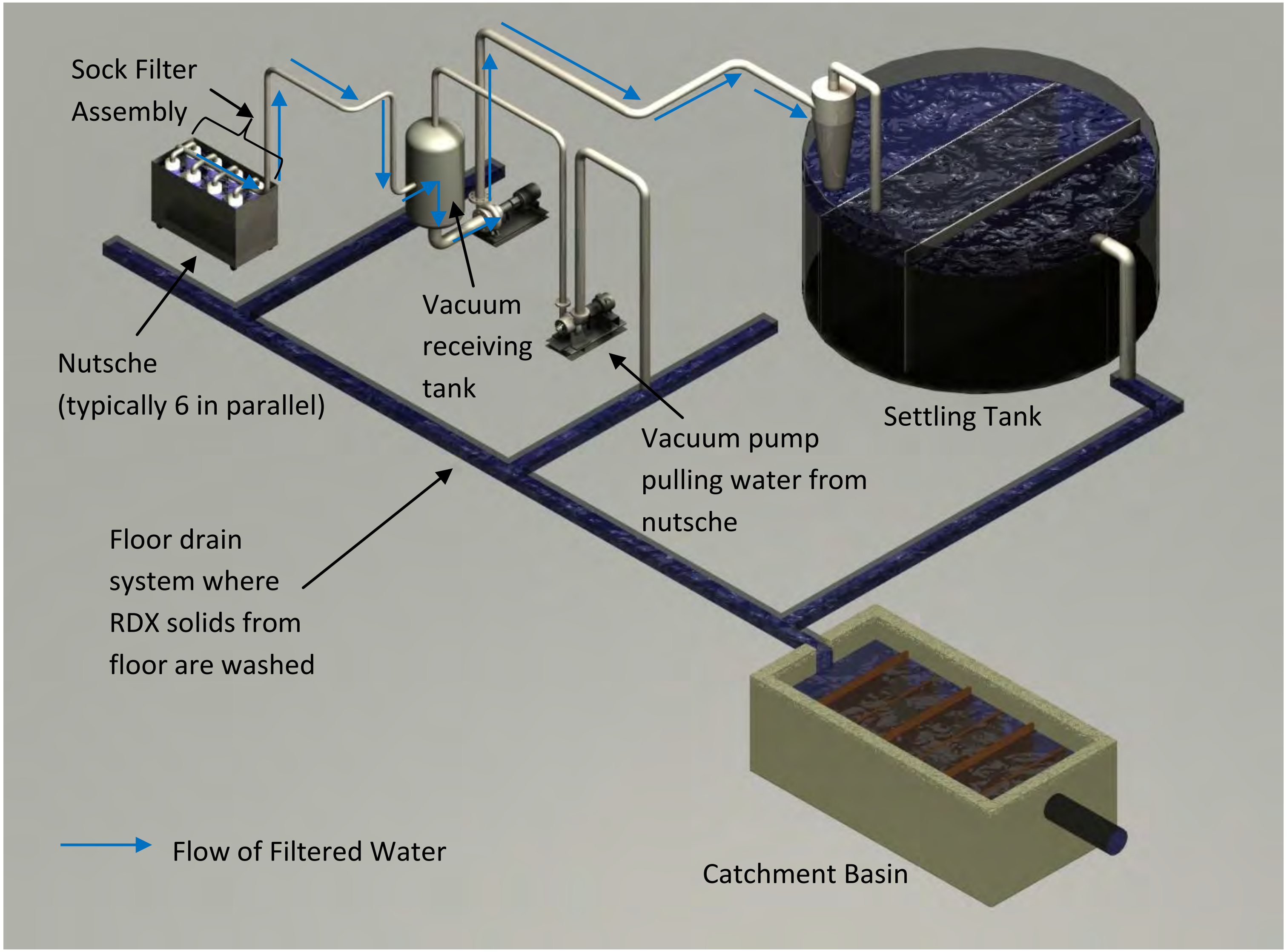
BAE Systems OSI had previously designed a modified nutsche without the problematic sock probes and tested it on a small scale with good results. They then designed two updated versions.

Dewatering Process Overview



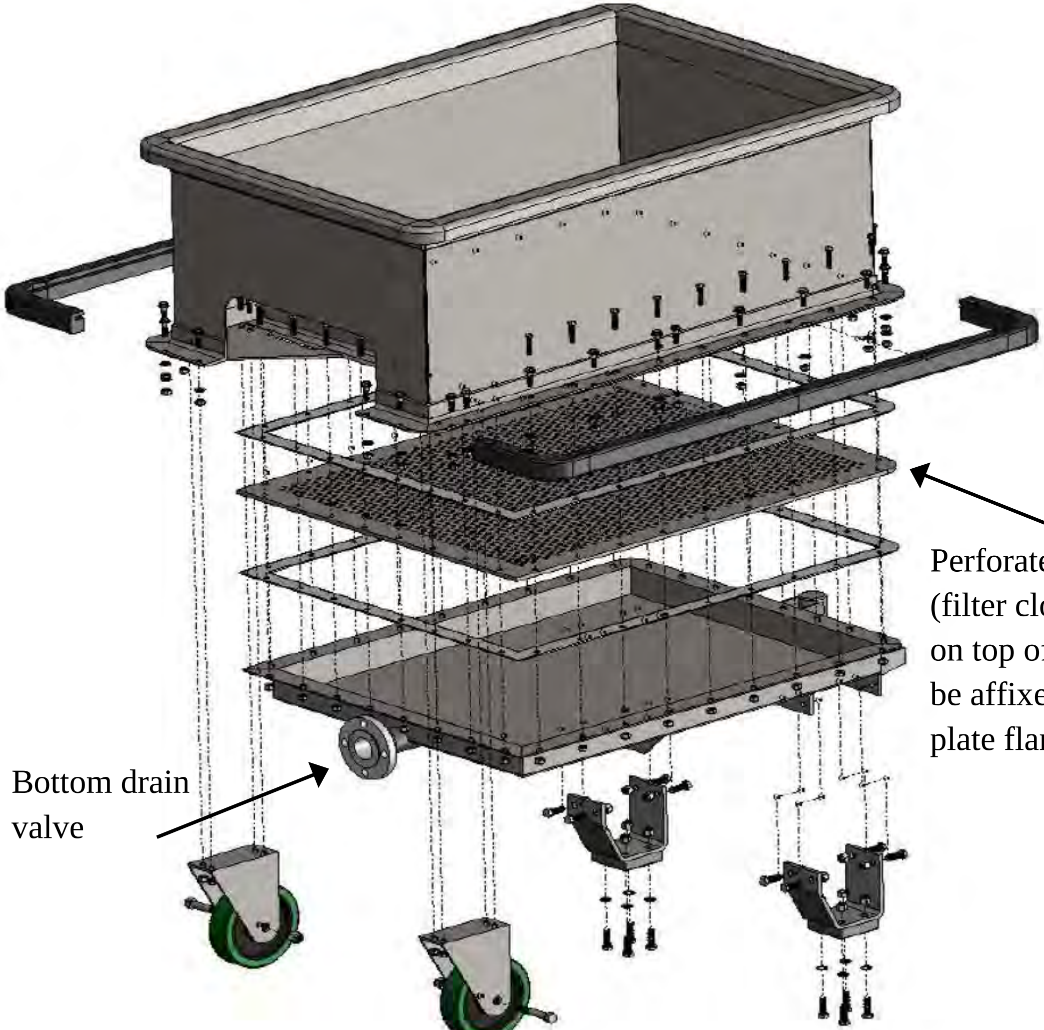
Design Alternatives

- 4 different alternatives will be evaluated in this demonstration/validation (dem/val) project
- 2 have already been used in the RDX manufacturing process at Holston AAP
  - Design #1: Status Quo
  - Design #4: Grid Bottom with Gooseneck
- 2 prototypes were designed by BAE Systems OSI and constructed for this dem/val
  - Design #2: False Bottom Nutsche
  - Design #3: Grid Bottom Nutsche

Design #1: Status Quo

- Noted Problems
  - Non-uniform drying of RDX
  - Water heel in nutsche bottom
  - RDX solids falling to floor

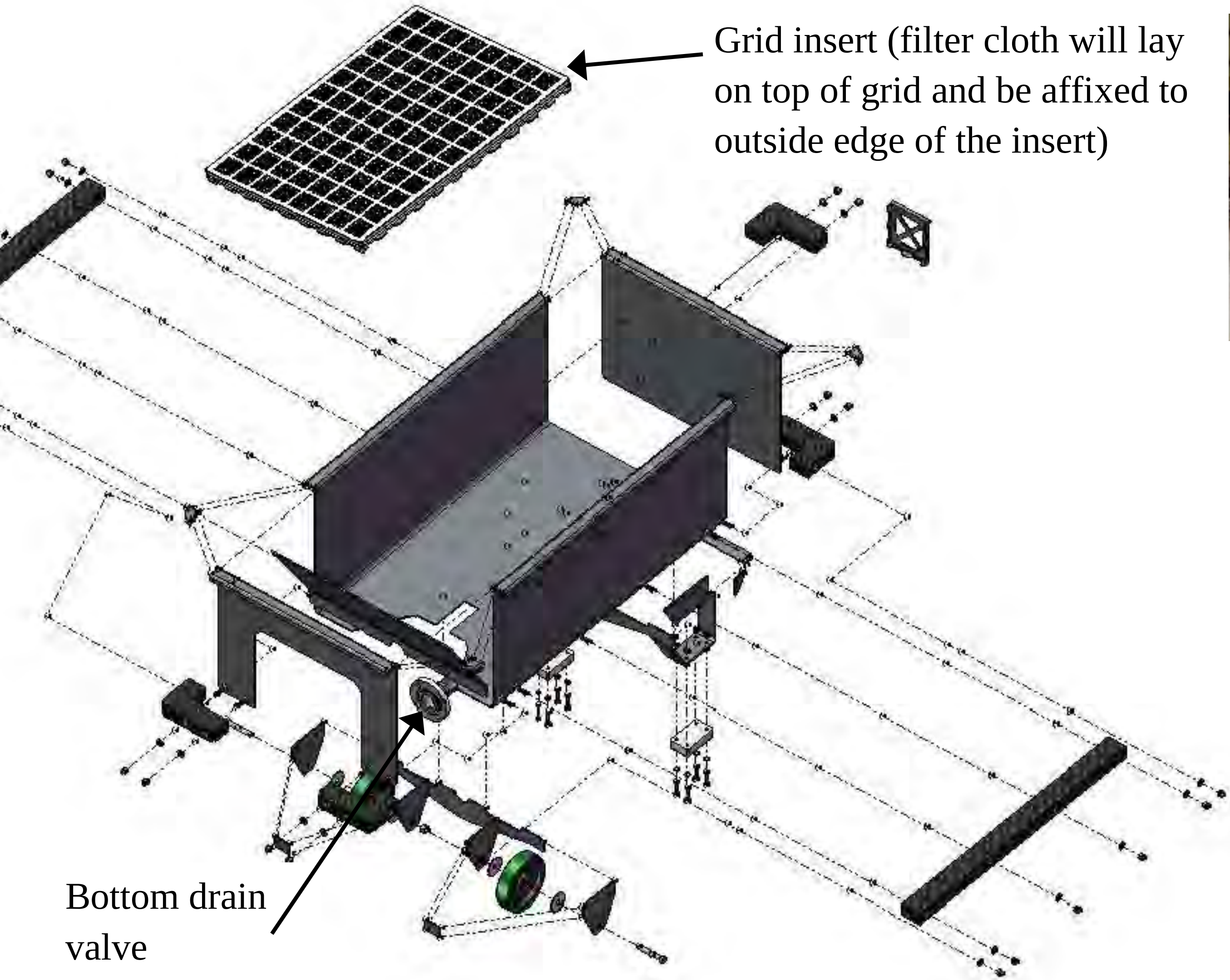
Design #2: False Bottom Nutsche



Perforated plate (filter cloth will lay on top of plate and be affixed to outside plate flange)

Bottom drain valve

Design #3: Grid Bottom Nutsche



Grid insert (filter cloth will lay on top of grid and be affixed to outside edge of the insert)

Bottom drain valve

Design #4: Grid Bottom with Gooseneck

Qualifying Test Run

- Designs #1 & #4 already used on-site at Holston AAP
- Designs #2 & #3 prototypes manufactured and delivered
- For Designs #2 & #3, safety evaluation procedures had to be followed to allow for use of new equipment in process
  - Prototype validation and familiarization
  - Safety Team review
  - Static test run
  - Transport test run

Qualifying Test Run Lessons Learned

- Sealing corners was difficult on Design #3 (Grid Bottom)
- O-ring vs. Gore-Tex® only seal

More Lessons Learned

- Torque requirements need established for flanges where top and bottom pieces are secured for Design #2 (False Bottom)

- Filter fabric restricting flow thru bottom drain; new method to secure fabric required for Design #3 (Grid Bottom)

Dem/Val Testing

- Phase I: Evaluate RDX Dewatering Efficiency
  - Evaluate moisture removal
  - Evaluate processing time to dewater RDX
  - Evaluate RDX concentration reduction in water
  - Evaluate quantity of RDX solids falling to floor/ending up in wastewater
  - Evaluate additional dewatering after transport

Dem/Val Testing (continued)

- Phase II: Assess Operations and Maintenance Impacts
  - Estimate quantity of water used in floor clean-up
  - Estimate quantity of water used in sock probe hydraulics
  - Determine optimal dewatering time
  - Determine impacts to next process steps (drying time)
  - Determine time to filter fouling
  - Determine filter useful life
  - Assess impacts to vacuum pump
  - Other Operations and Maintenance (O&M) impacts (as determined during testing)

Expected Outcomes

- Due to preliminary testing, it is expected that Designs #2, #3, and #4 will provide a more uniform dewatering of RDX and possibly reduce the time required for dewatering and drying
- If one of the new nutsche designs is implemented, the following are expected:
  - Water savings will be realized in the elimination of the hydraulic lifts for the sock probes (estimated at 6000 gallons per day per building) and also in housekeeping operations to clean up RDX from the floor
  - Lower wastewater volume, which should have an additional cost savings to Holston AAP
  - Impacts to the concentration of RDX in wastewater stream

Contact Information

- **NDCEE Technical Monitor (TM)**
  Task: 0473-A1 Wastewater Microfiltration for RDX Recycling
  Name: Mr. Donald Yee
  Organization: PEO Ammo
  E-mail: donald.w.yee@us.army.mil
  Phone Number: (973) 724-6286

- **NDCEE Project Manager (PM)**
  Name: Paul Brezovec
  Organization: *CTC*/NDCEE
  E-mail: brezovec@ctc.com
  Phone Number: (814) 269-2844

- **PM for Joint Services**
  Name: Gregory O'Connor
  E-mail: gregory.j.oconnor@us.army.mil
  Phone Number: (973) 724-5008

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